# ICTAL EEG PATTERNS IN GENERALIZED SEIZURES

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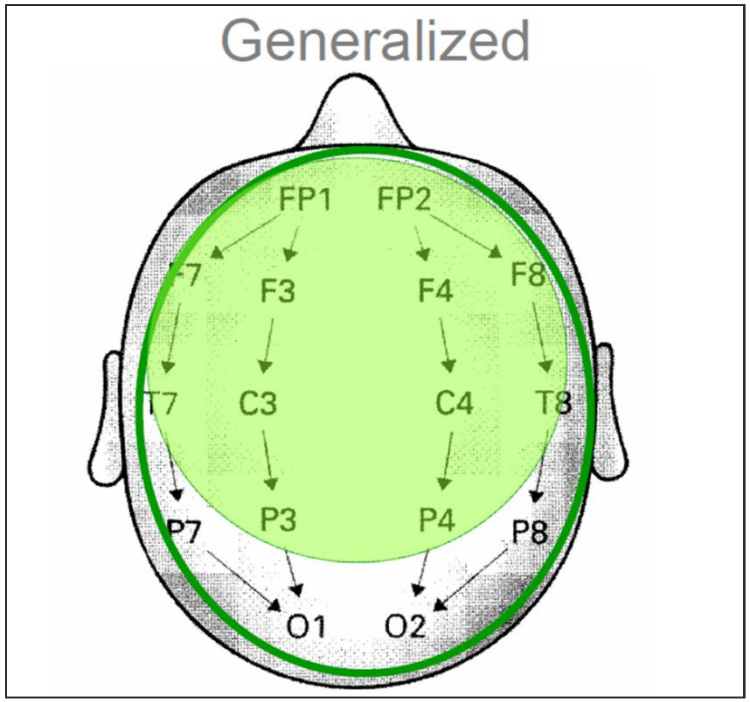
# Generalized epilepsies and syndromes

- Epileptic disorders with generalised seizures
- The first clinical changes indicate initial involvement of *both hemispheres*
- The ictal encephalographic patterns initially are *bilateral*



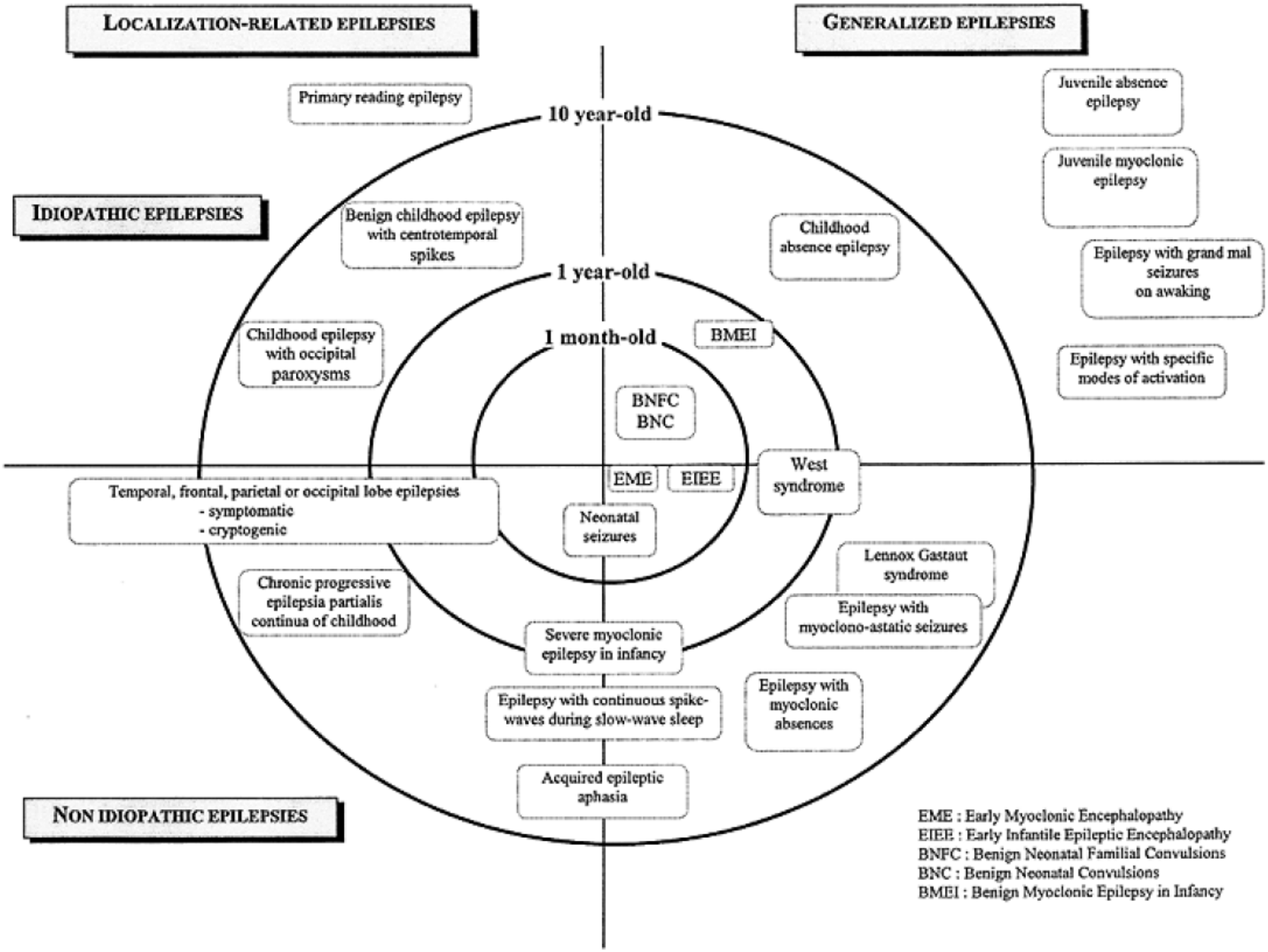
# Classification of Seizures
## (ILAE 1981)

- **Partial seizures**
  - Simple partial seizures (SPS)
  - Complex partial seizures (CPS)
  - Focal seizures evolving to secondarily generalized seizures

- **Generalized seizures**
  - Absence seizures
  - Myoclonic seizures
  - Tonic seizures
  - Clonic seizures
  - Tonic-clonic seizures
  - Atonic seizures

# Classification of the Epilepsies
## (Adapted from Tich and Pereon, 1999)

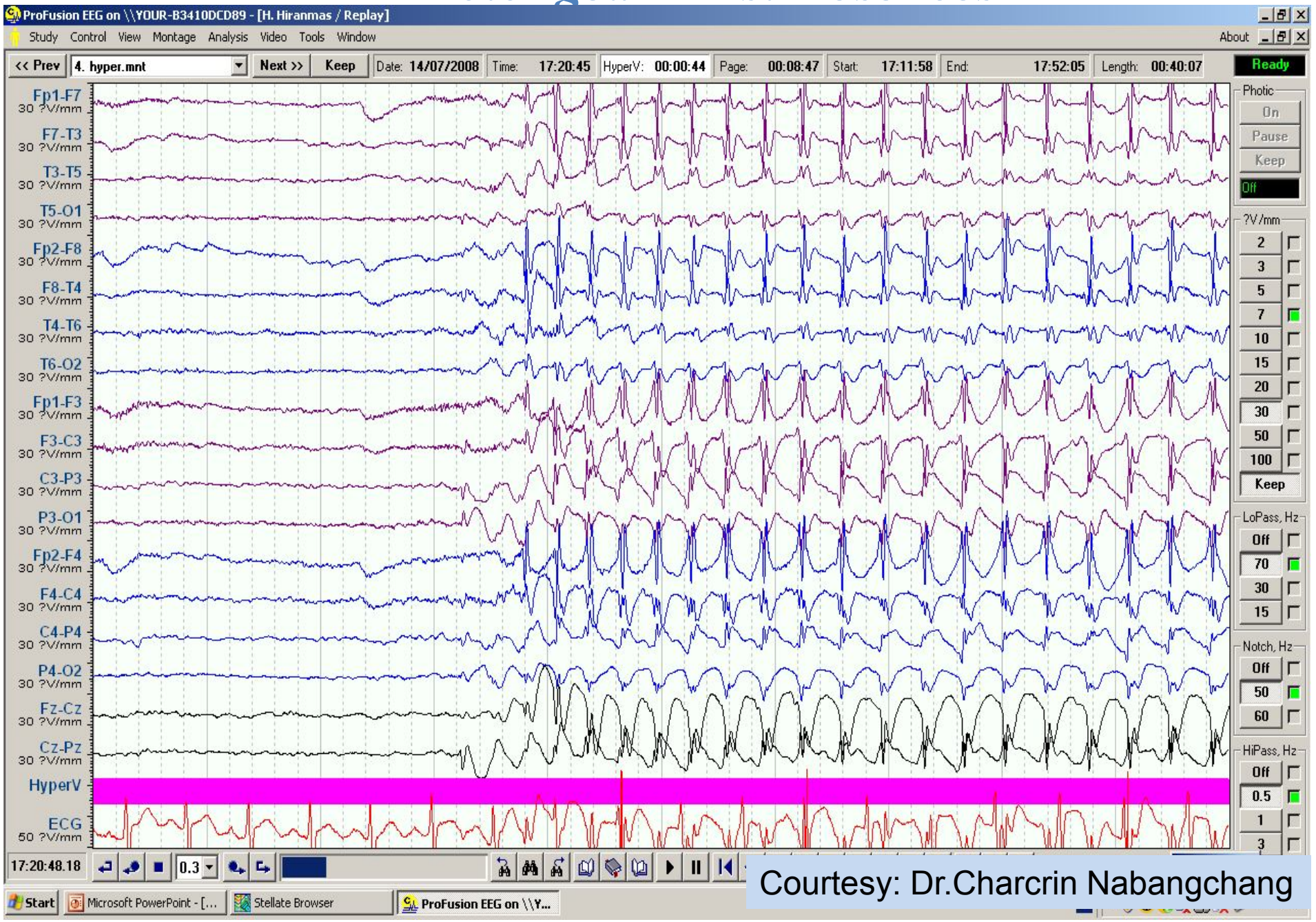
| | Generalized | Localization-related |
|---|---|---|
| Idiopathic | Childhood absence epilepsy | Benign focal epilepsy of childhood (2 types) |
| | Juvenile absence epilepsy | |
| (genetic) | Juvenile myoclonic epilepsy | |
| | Epilepsy with grand-mal seizures on awakening | ADNFLE* |
| | Other idiopathic generalized epilepsies | Primary reading epilepsy |
| Symptomatic | West syndrome | Mesiotemporal lobe epilepsy |
| | Lennox-Gastaut syndrome | |
| or cryptogenic | Other symptomatic generalized epilepsies | Neocortical focal epilepsy |


LOCALIZATION-RELATED EPILEPSIES
GENERALIZED EPILEPSIES
IDIOPATHIC EPILEPSIES
NON IDIOPATHIC EPILEPSIES
10 year-old
1 year-old
1 month-old
Primary reading epilepsy
Juvenile absence epilepsy
Juvenile myoclonic epilepsy
Benign childhood epilepsy with centrotemporal spikes
Childhood absence epilepsy
Epilepsy with grand mal seizures on awaking
Childhood epilepsy with occipital paroxysms
BMEI
Epilepsy with specific modes of activation
BNFC
BNC
EME
EIEE
West syndrome
Temporal, frontal, parietal or occipital lobe epilepsies
- symptomatic
- cryptogenic
Neonatal seizures
Lennox Gastaut syndrome
Chronic progressive epilepsia partialis continua of childhood
Epilepsy with myoclono-astatic seizures
Severe myoclonic epilepsy in infancy
Epilepsy with continuous spike-waves during slow-wave sleep
Epilepsy with myoclonic absences
Acquired epileptic aphasia
EME : Early Myoclonic Encephalopathy
EIEE : Early Infantile Epileptic Encephalopathy
BNFC : Benign Neonatal Familial Convulsions
BNC : Benign Neonatal Convulsions
BMEI : Benign Myoclonic Epilepsy in Infancy

# Ictal EEG

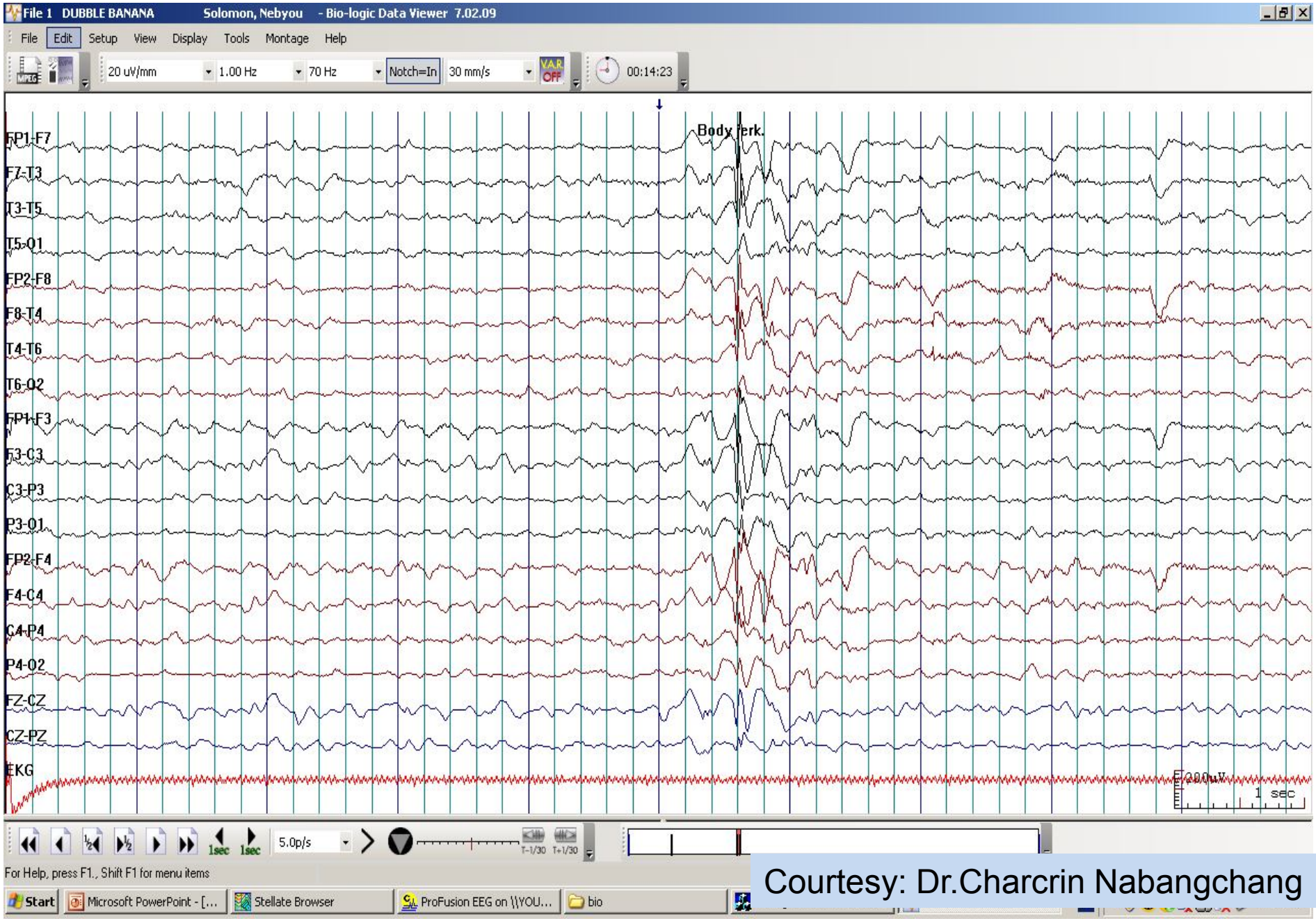
- Abrupt cessation of interictal epileptiform abnormalities immediately before ictal onset
- Rhythmic activity  that evolve in frequency, field or amplitude in focal seizures
- Isomorphic patterns such as repetitive interictal discharges
- Bursts of generalized epileptic discharges

# *Prolonged IEDs: Absences*



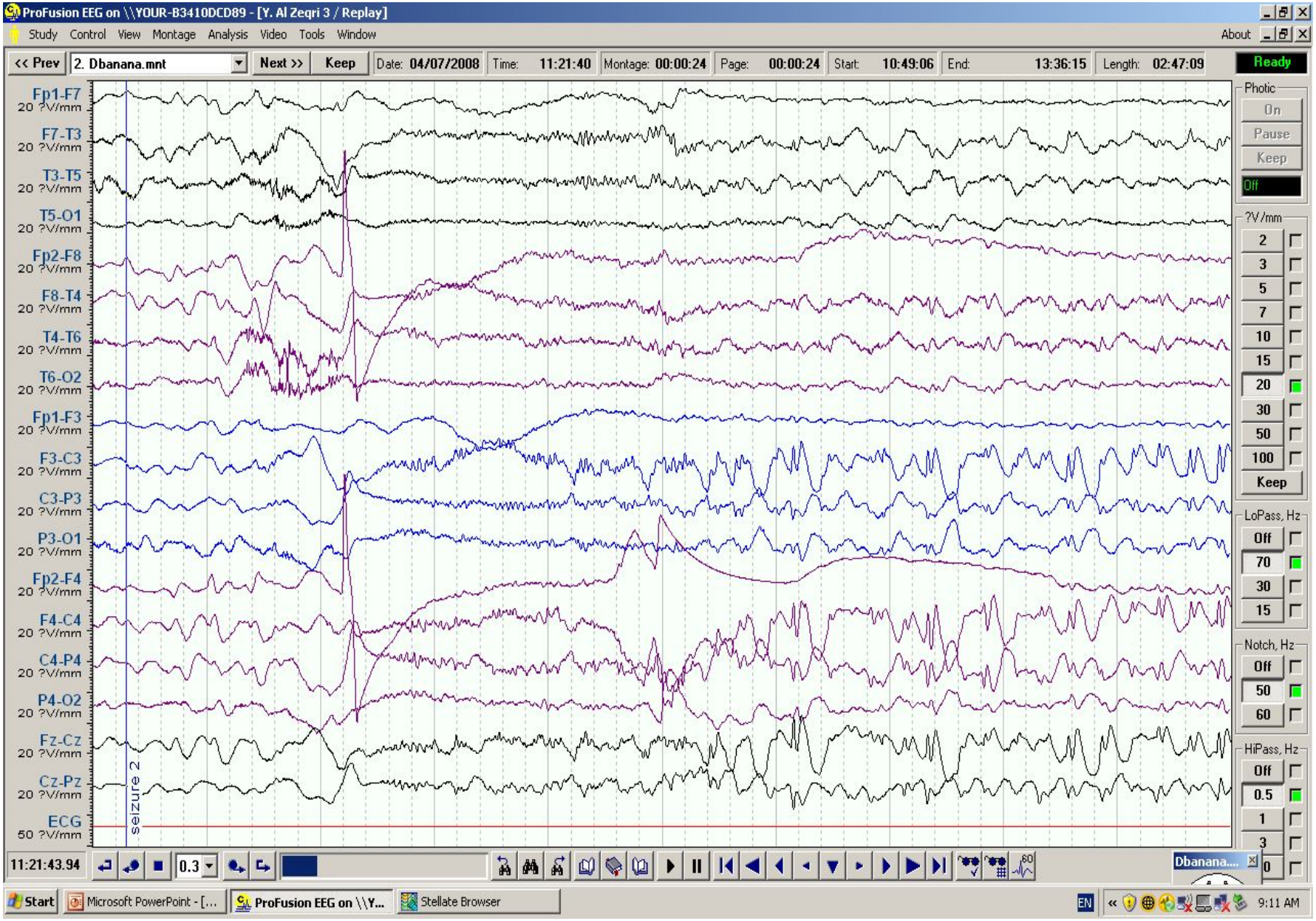

Courtesy: Dr.Charcrin Nabangchang

# Bursts of generalized epileptic discharges, Myoclonic Sz

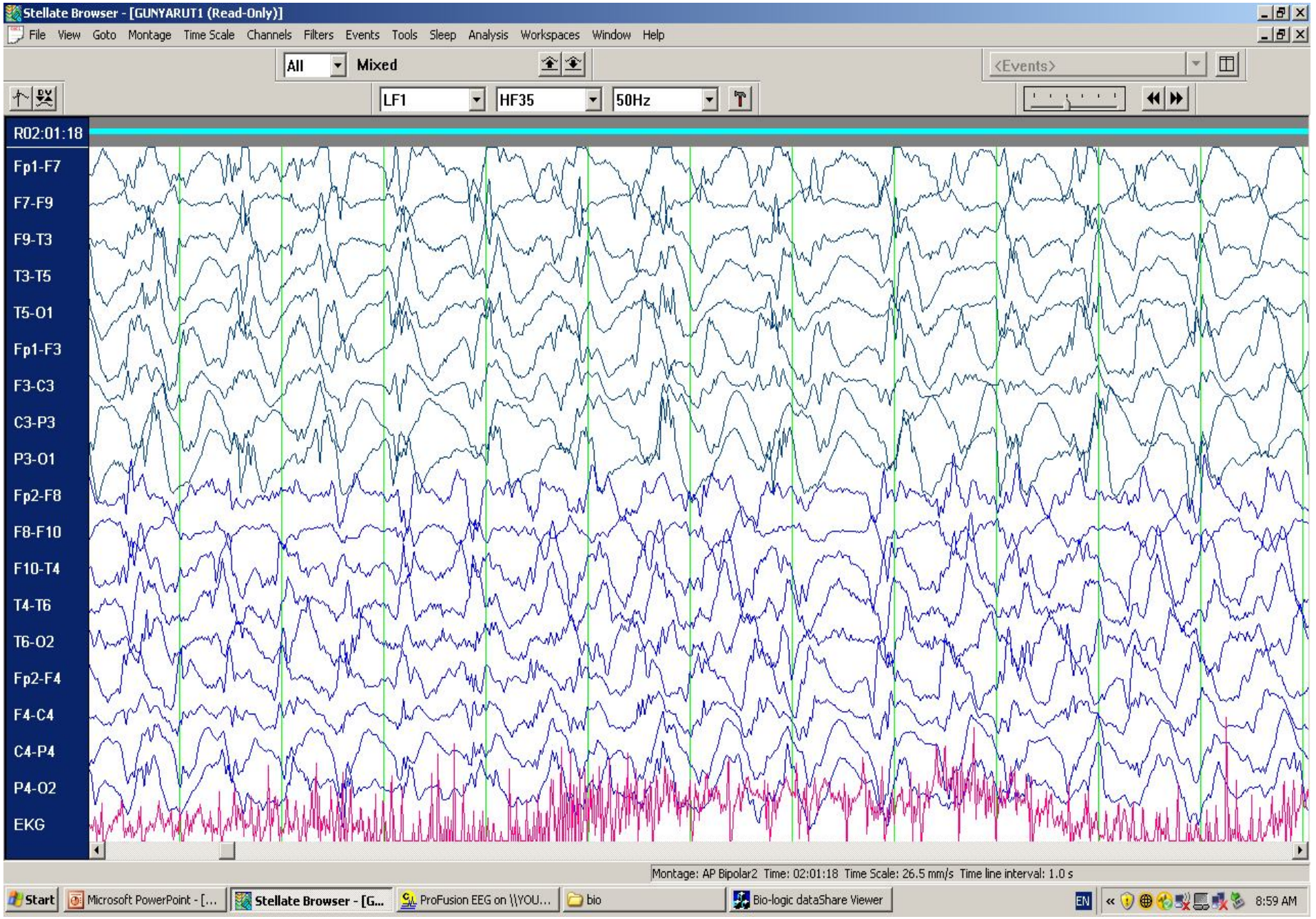



Courtesy: Dr.Charcrin Nabangchang

# Generalized Background Attenuation: Generalized Tonic Seizures



# Grand Mal (Clonic Phrase)



# Generalized Epileptic syndromes
## (ILAE 1989)

**2. Generalised epilepsies and syndromes**

2.1 Idiopathic (with age-related onset – listed in order of age)

- Benign neonatal familial convulsions
- Benign neonatal convulsions
- Benign myoclonic epilepsy in infancy
- Childhood absence epilepsy (pyknolepsy)
- Juvenile absence epilepsy
- Juvenile myoclonic epilepsy (impulsive petit mal)
- Epilepsy with grand mal (GTCS) seizures on awakening
- Other generalised idiopathic epilepsies not defined above
- Epilepsies with seizures precipitated by specific modes of activation

2.2 Cryptogenic or symptomatic (in order of age)

- West syndrome (infantile spasms, Blitz–Nick–Salaam Krampfe)
- Lennox–Gastaut syndrome
- Epilepsy with myoclonic–astatic seizures
- Epilepsy with myoclonic absences

2.3 Symptomatic

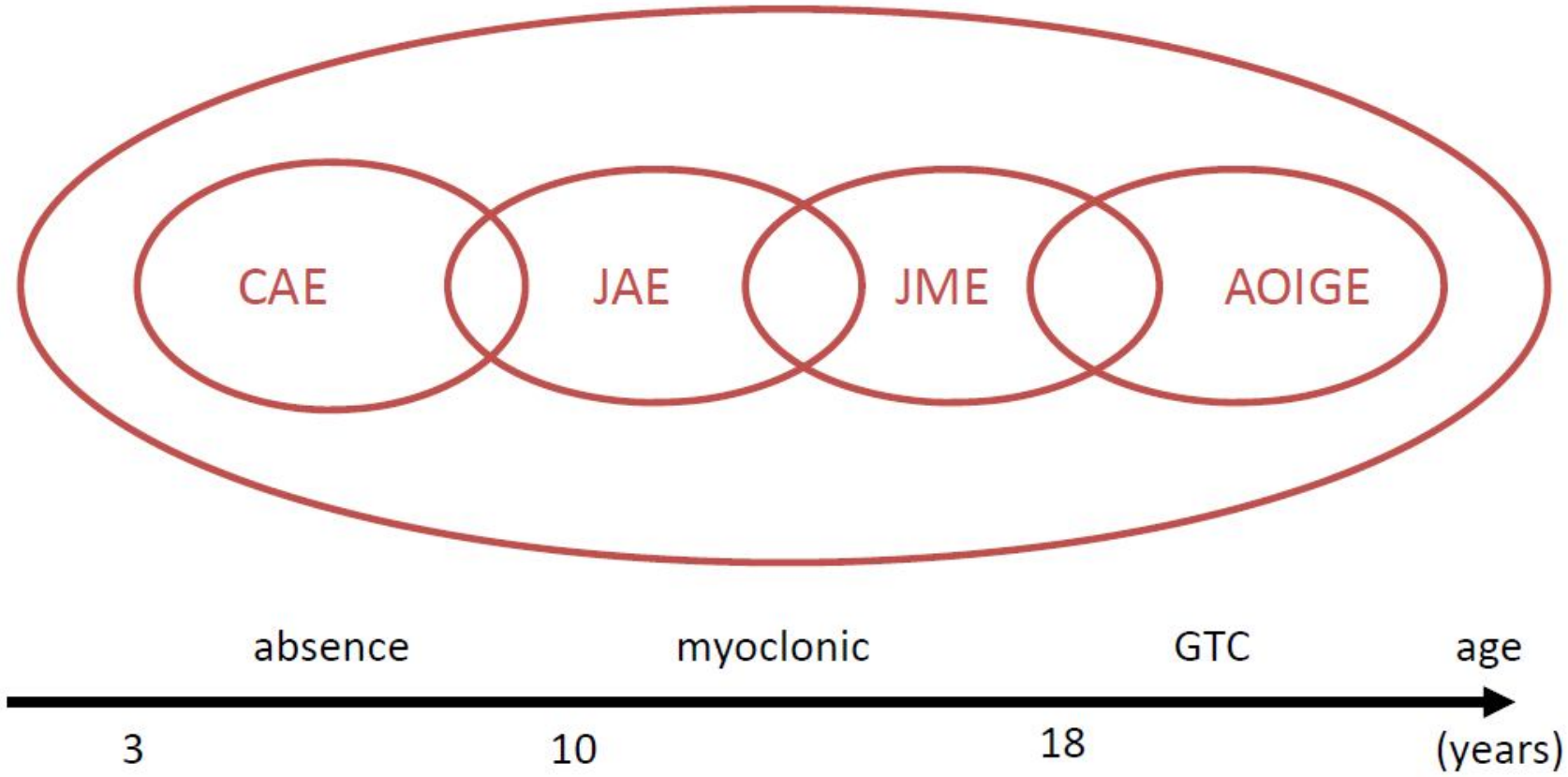
2.3.1 Non-specific aetiology

- Early myoclonic encephalopathy
- Early infantile epileptic encephalopathy with suppression burst
- Other symptomatic generalised epilepsies not defined above

2.3.2 Specific syndromes

- Epileptic seizures may complicate many disease states. Under this heading are included diseases in which seizures are a presenting or predominant feature

# IGE: Age-related Continuum of Conditions



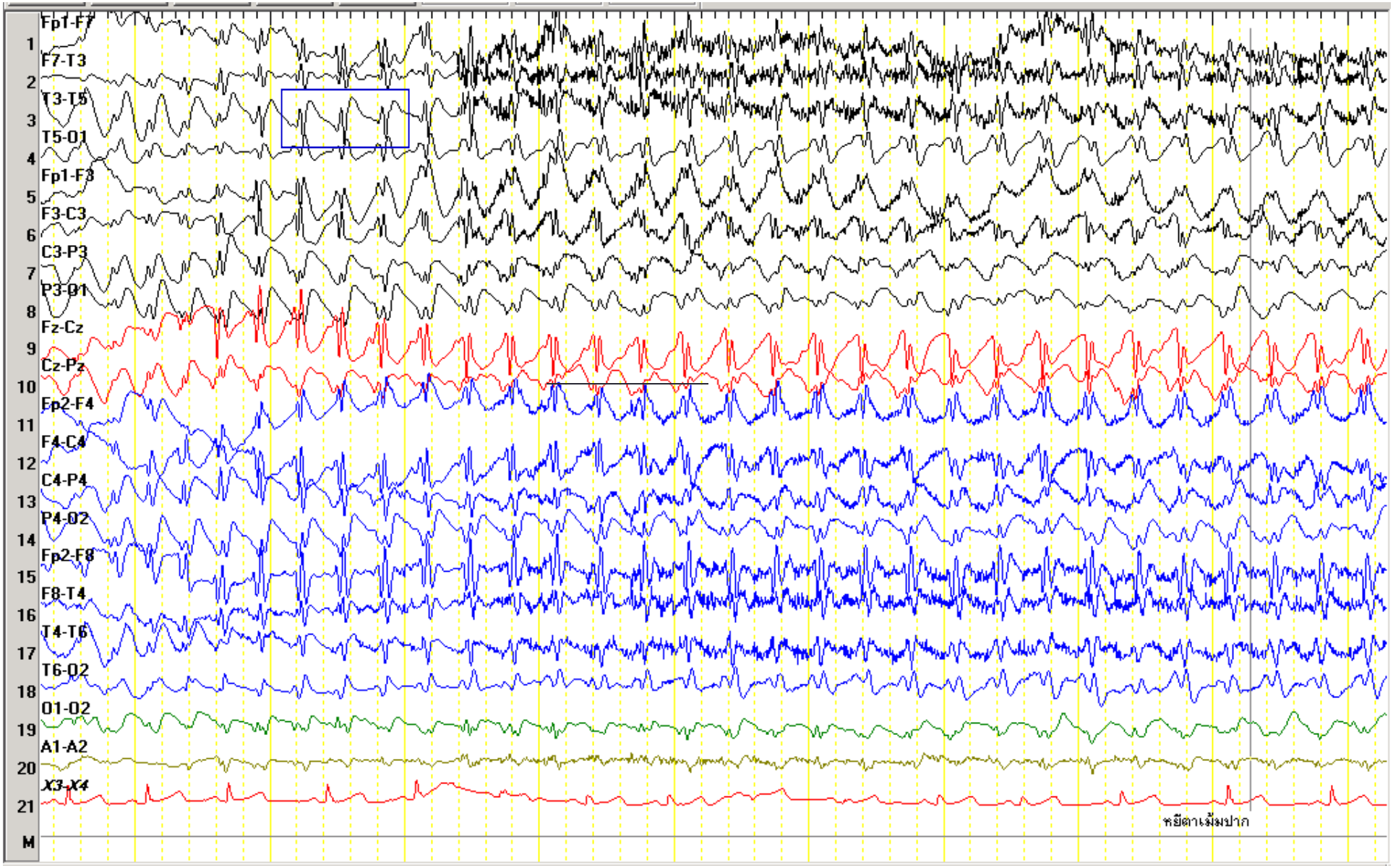
# Childhood absence epilepsy

- Age of onset: typically school-aged
- Seizure types: Absence
  Generalized tonic-clonic (approximately 50% of patients)
- Neurologic examination, IQ, imaging : normal
- Prognosis : Spontaneous remission by adulthood for approximately 30-50% of patients

# Ictal EEG

- video

# 3 Hz Spike-waves complex



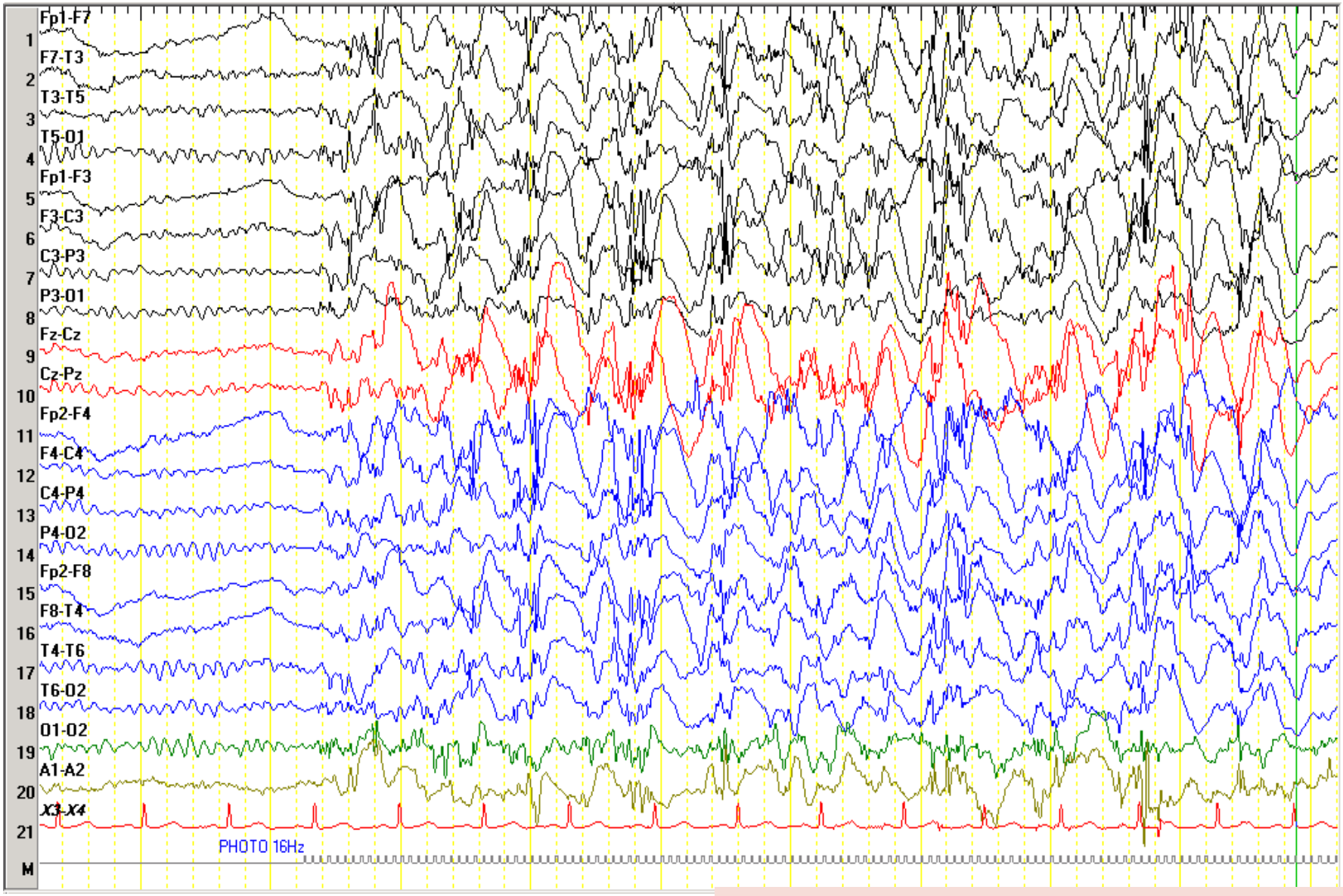
# Juvenile absence epilepsy

- Onset 9-13 years
- GTC found 80%
- EEG: generalized 3 to 4 Hz spike-and-wave discharges (which is slightly faster than CAE)
- They have also been reported to be slightly less rhythmic and less organized than the spike-and-wave complexes seen in CAE

# Juvenile Myoclonic Epilepsy

- Janz syndrome
- Peak onset: 14-16 years
- Precipitants: photosensitivity, sleep deprivation
- Susceptibility genes: chromosome 6p11-12 (EJM1) and 15q14 (EJM2)
- Seizures
  - Sudden, mild to moderate myoclonic jerkings (shoulder & arm) during awake
  - GTC seizures (90%) often preceded by series of jerks
  - Typical absence (30%)
- EEG: polyspikes-wave 4-6 Hz

# Polyspikes-wave Produced by Photic Stimulation

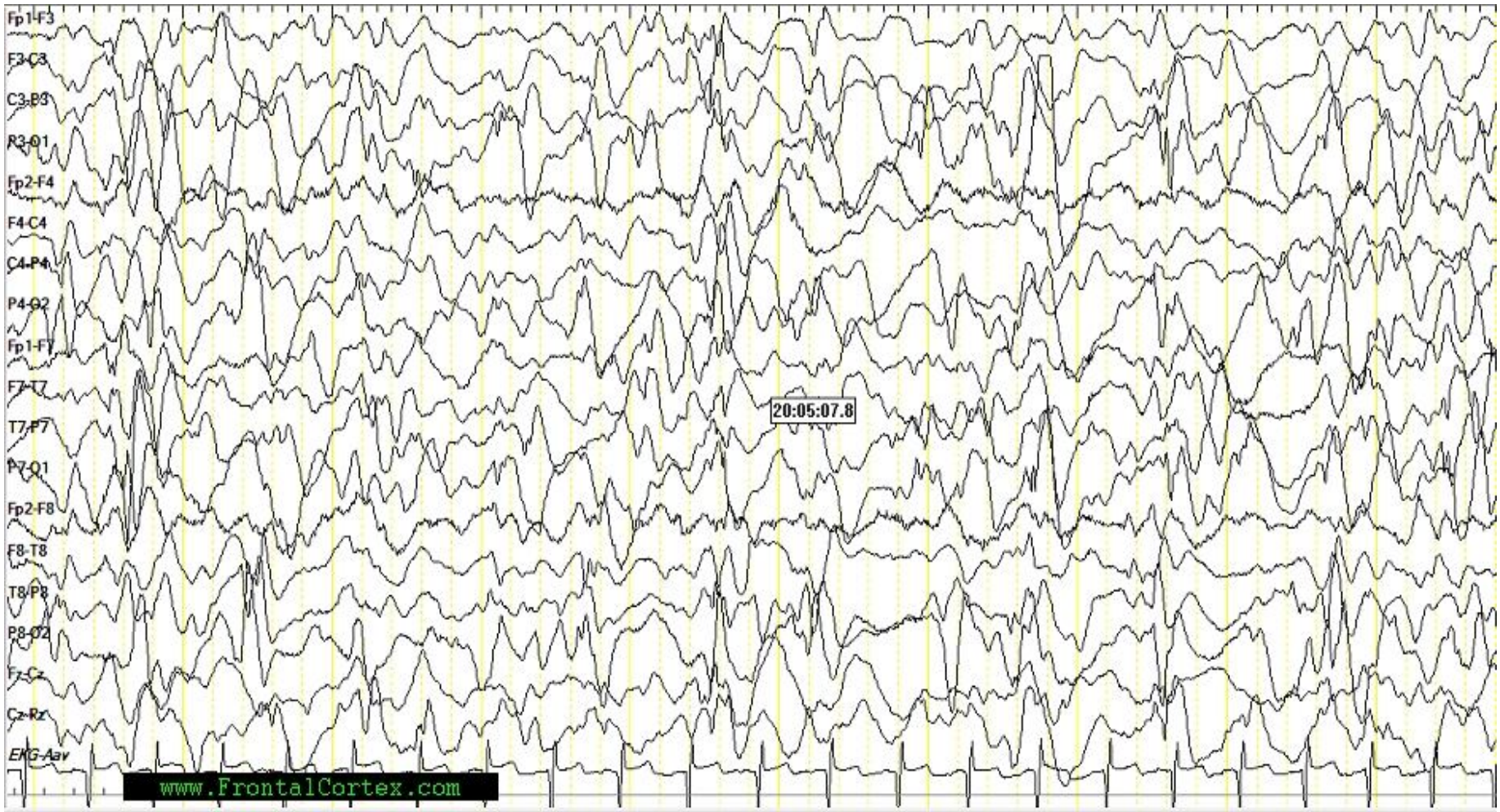



Courtesy: Dr.Kullasate Sakpichaisakul

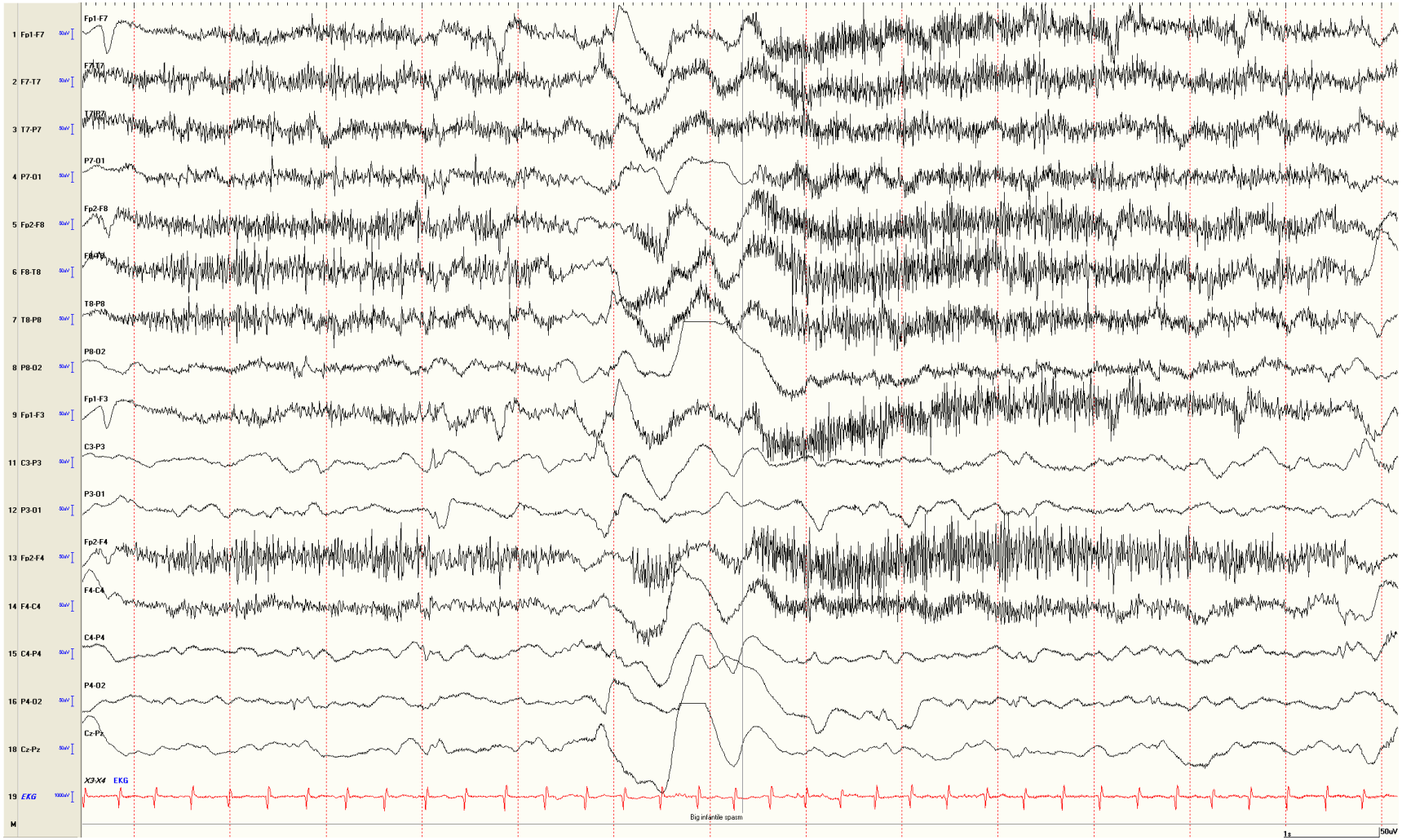
# West Syndrome

- Triad:
  - Seizure: infantile spasm (symmetric, salaam-like contractions of trunk + extension and elevation of arms + tonic extension of legs)
  - Developmental delay
  - Typical EEG: hypsarrhythmia and variants
- Ictal EEG:
- Age at onset: early infancy, peak 4-7 mo
- Etiology: various causes
- Look for tuberous sclerosis complex
- Very difficult to treat seizure

# Hypsarrhythmia



# Ictal EEG

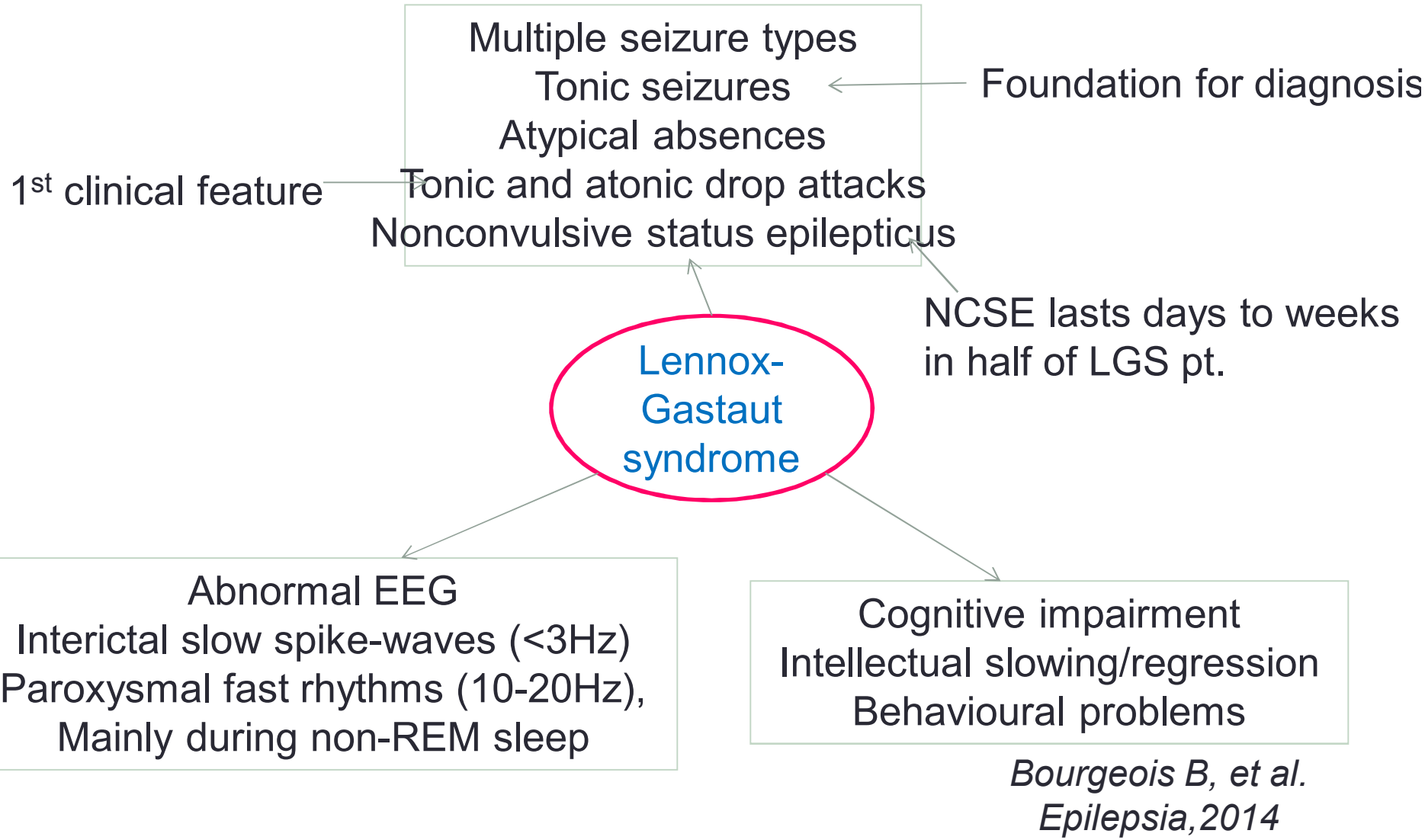

1 Fp1-F7
2 F7-T7
3 T7-P7
4 P7-O1
5 Fp2-F8
6 F8-T8
7 T8-P8
8 P8-O2
9 Fp1-F3
11 C3-P3
12 P3-O1
13 Fp2-F4
14 F4-C4
15 C4-P4
16 P4-O2
18 Cz-Pz
19 EKG
M
Fp1-F7
P7-O1
Fp2-F8
T8-P8
P8-O2
Fp1-F3
C3-P3
P3-O1
Fp2-F4
C4-P4
P4-O2
Cz-Pz
X3-X4 EKG
Big infantile spasm
1s
50uV

# Lennox-Gastaut syndrome (LGS)

- LGS is a severe epileptic encephalopathy, usually beginning in childhood between 3-5 years of age but can be observed anytime between 1-8 years of age
- Patients with LGS account for 5-10% of children with seizure
- 70-80% of patients will manifest a known structural (symptomatic) brain problem, 20-30% of cases are cryptogenic
- ~30-65% of patients had west syndrome before onset
- Prognosis for LGS is very poor: 94-96% of LGS patients will manifest medically intractable epilepsy and nearly all have cognitive and behavioral problems.

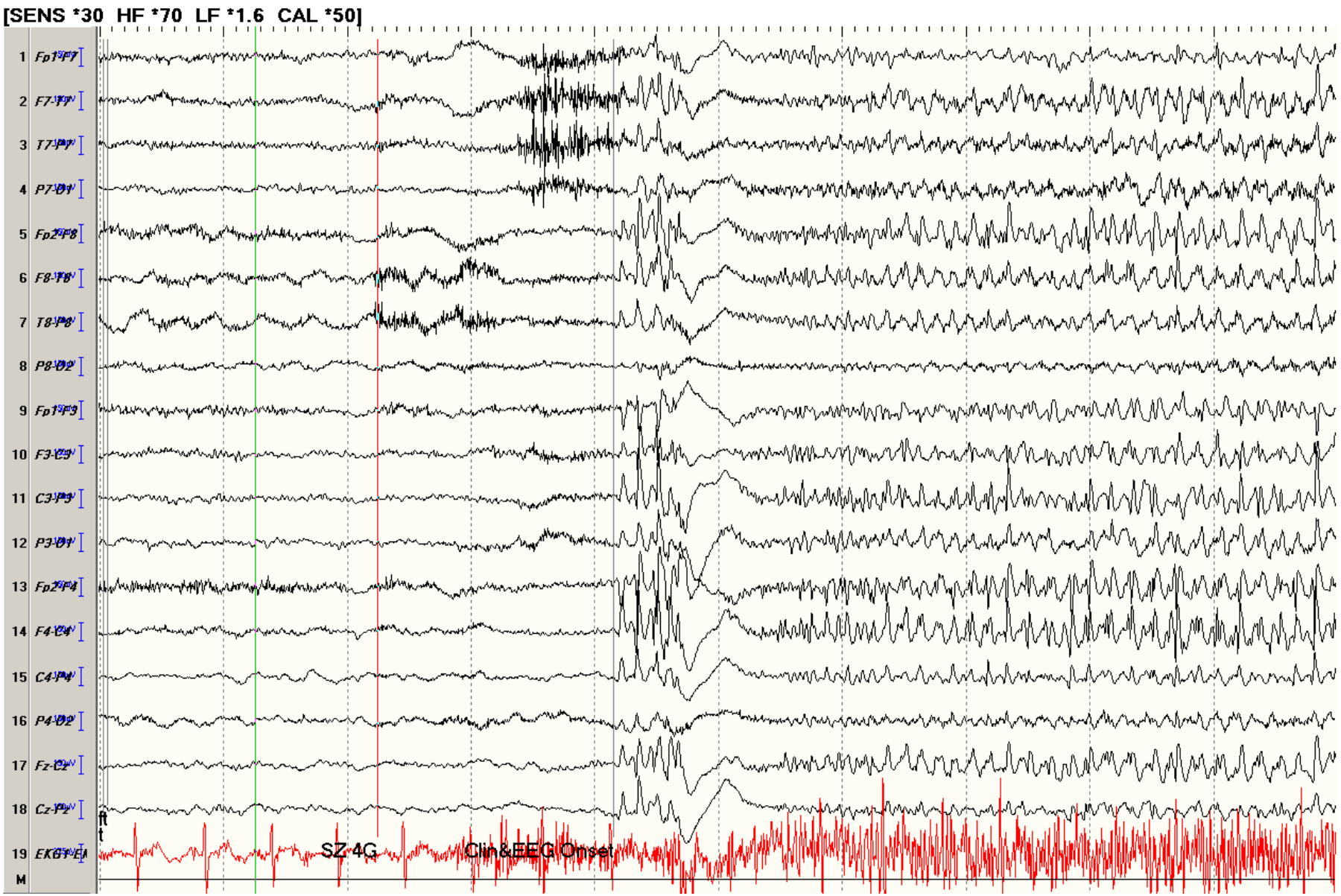
Camfield P epilepsia 2007
Vanstraten AF, Pediatric Neurology 2012

# The classic diagnosis criteria for LGS




*Bourgeois B, et al. Epilepsia,2014*

# Ictal EEG – Tonic seizure



# Things to be concerned about IGE

- Provoking and Confounding factors affecting the EEG
  - Arousal, sleep and sleep deprivation
  - Hyperventilation
  - Photic stimulation
  - Reflex triggers
- Generalized seizures with focal EEG features
- DDx Secondary bilateral synchrony

*Epilepsia*, **46**(10):1668–1676, 2005
Blackwell Publishing, Inc.


# Focal Semiologic and Electroencephalographic Features in Patients with Juvenile Myoclonic Epilepsy

Naotaka Usui, Prakash Kotagal, Riki Matsumoto, Christoph Kellinghaus, and Hans Otto Lüders

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# Secondary bilateral synchrony

- EEG looks like IGE (generalized spike-wave complexes)
- But it is really a focal epilepsy
- How to make the diagnosis
  - Clear evidence for focality
  - Interictal EEG
  - Ictal features : Clinically and electrically
  - MRI lesion

Don’t step into the trap!

# THANK YOU